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DISTRIBUTION AND DENSITY OF SUBMERGED AQUATIC VEGETATION BEDS IN A CONNECTICUT HARBOR

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ABSTRACT. Submerged aquatic vegetation (SAV), *Zostera marina* and *Ruppia maritima,* was surveyed and mapped for an inventory of inner Clinton Harbor, Clinton, Connecticut. Transects set at 30 meter intervals were established along the northern shoreline of the inner harbor, and SCUBA was utilized to count SAV short shoot densities. Surveys revealed that the majority of the inner harbor was dominated by nine areas (ca. 11 ha) of low density seagrass beds. In addition, nine areas (ca. 6.5 ha) of high density seagrass beds and ten areas (ca. 5.5 ha) of medium density seagrass beds were located. No SAV was found in the navigational channel or upon the mudflat along the northern shore of the inner harbor.

Key Words: SAV, distribution, Long Island Sound, Clinton Harbor

Submerged aquatic vegetation (SAV) of the North American Atlantic coastal waters supports highly diverse animal assemblages (Heck et al. 1989; Rozas and Odum 1987). Seagrass beds function as refugia, energy sources, and habitat for the animals inhabiting the beds (Heck et al. 1989; Sogard and Able 1991). A decline in seagrass bed production would have profound effects upon these animal assemblages and would decrease detrital export, greatly reducing energy sources for other fauna not directly inhabiting SAV beds (Thayer et al. 1984).

The reduction of SAV in the coastal United States has been well documented (Kemp et al. 1983; Orth and Moore 1983; Roblee et al. 1991; Thayer et al. 1994). Natural causes of SAV decline such as disease, storm events, salinity fluctuations, and hypoxic events coupled with anthropogenically induced eutrophication currently threaten the production of many SAV communities (Durako and Kuss 1994; Koch and Beer 1996; Montague and Ley 1993; Olesen and Sand-Jensen 1994; Zieman et al. 1994). Therefore, documenting the distribution of SAV is important in developing baseline data which can be used to monitor abundance patterns and ecological health over extended periods of time.

The distribution of SAV (*Zostera marina* L. and *Ruppia maritima* L.) along the Connecticut coast of Long Island Sound has been previously documented by Koch and Beer (1996). However, detailed maps of the extent of seagrass beds within individual bays and harbors are not available. Historically, SAV has been reported to occur in Long Island Sound as far west as New York State but is now limited to the easternmost third of Long Island Sound (Koch and Beer 1996). Clinton Harbor is considered the westernmost distribution point of seagrass in Long Island Sound (Koch and Beer 1996) and was selected as a study site to monitor changing SAV distribution patterns. The purpose of this study was to provide baseline information on the density and the distribution of SAV in inner Clinton Harbor (Clinton, CT).

Clinton Harbor occupies 162 ha and is located on the Connecticut shore of Long Island Sound. The harbor is a drowned river valley inundated by seawater and receives freshwater input from the Hammock, Indian, and Hammonasset Rivers. Inner Clinton Harbor is the mouth of the Hammonasset River and is formed by the presence of the Cedar Island spit (Figure 1). The tides within the harbor are semi-diurnal and display a mean tidal range of 1.5 meters. Clinton Harbor is a rural harbor with 60% of its bordering land edge being utilized as wetlands and beaches, 25% as marinas, and 15% as residential housing (Mroczka 1991).

MATERIALS AND METHODS

SAV densities were measured in inner Clinton Harbor from August 15, 1990 through October 31, 1990. Inner Clinton Harbor was divided into 33 transects set at 30 m intervals along the shoreline. The transect positions were established with survey equipment, marked with stakes, and subsequently plotted on a hydrographic survey map.

SAV densities were obtained using SCUBA. Divers moved

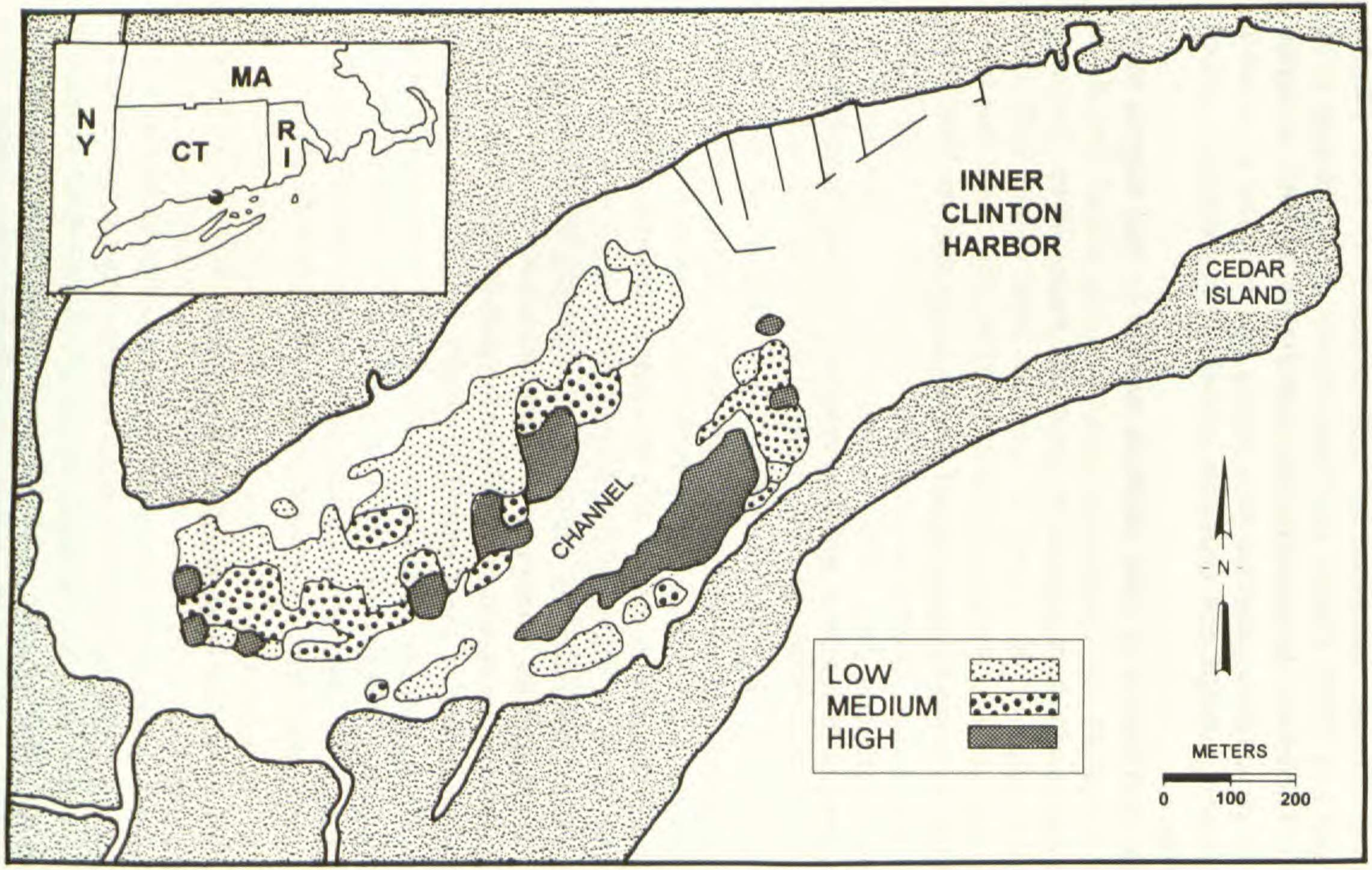

Figure 1. Map of inner Clinton Harbor indicating the location and density of submerged aquatic vegetation. Density categories are expressed as the mean number of short shoots per m^2 (Low = 0–20; Medium = 21–40; High $\geq$ 41).

along a calibrated 200 m line making observations at 15 m intervals. At each interval, SAV short shoot densities were counted in two randomly placed 0.5 m^2 grids. *Zostera marina* and *Ruppia maritima* short shoots were not differentiated in the counts. Counts were adjusted to m^2 values and the mean of the two counts was then calculated and used as a datum point for mapping. A total of 662 sampling points, each sampled once, was used in this study. SAV distribution was plotted on a survey map (Figure 1) using the density categories established from percent shoot coverage of a m^2 grid. The densities established were categorized as low (0–20 short shoots per m^2), medium (21–40 short shoots per m^2), and high ($\geq$41 short shoots per m^2). Area covered (ha) was then calculated for each density category with a Scalex Planwheel planimeter.

RESULTS

SAV was documented in an estimated 23 ha of inner Clinton Harbor. Although *Zostera marina* and *Ruppia maritima* shoots were not differentiated in the counts, the beds were dominated by *Z. marina.* Nine areas of low density SAV beds were identified (Figure 1). The low density beds were distributed throughout the study area, but were located primarily in areas north of the navigational channel. Low density beds occupied approximately 11 ha. Nine areas of high density SAV beds, occupying approximately 6.5 ha, were located laterally along the navigational channel (Figure 1). Ten areas of medium density beds were also identified laterally along the navigational channel (Figure 1). Medium density beds accounted for approximately 5.5 ha of all SAV beds. The mudflat along the northern shore of the inner harbor was unpopulated by SAV, as was the navigational channel.

DISCUSSION

Seagrass beds play integral roles in coastal ecology and have been suggested to be among the most productive aquatic ecosystems known (Day et al. 1989). Extensive declines in SAV along the coastal United States in the past few decades have made it necessary to document and monitor the extent of existing seagrass beds (Koch and Beer 1996; Olesen and Sand-Jensen 1994). Baseline data of SAV distribution will provide researchers and resource managers with the necessary information to begin to recognize and interpret the effects of both natural and anthropogenic impacts on the seagrasses, which will be critical for the future management of this resource.

The results of our 1990 survey have shown that inner Clinton Harbor was dominated by low density seagrass beds (Figure 1), which were located mainly in the areas north of the navigational channel. This portion of the harbor is dominated by poorly sorted mud/silt deposits (Mroczka 1991) and is typically exposed during periods of normal low tide. High turbidity significantly reduces light availability and the production of the beds throughout this area.

High and medium density SAV beds were identified in large aggregations laterally along the navigational channel (Figure 1). High flow rates of water through the navigational channel keep the surrounding sediments composed of well sorted sand grains (Mroczka 1991). High water flow also reduces the turbidity in the areas surrounding the channel making the water considerably clearer than that of the mudflats to the north. Water clarity in these areas permits the critical light level to extend to the bottom, allowing for more productive seagrass beds (Day et al. 1989; Duarte 1991).

The lack of SAV within the navigation channel is due to the depth of the channel and periodic oyster dredging. The 3 m depth of the navigational channel does not allow sunlight to penetrate to a level that is conducive to SAV growth (Duarte 1991). Periodic oyster dredging in the channel also precludes the establishment of SAV beds.

Our study provides baseline data on the general distribution of SAV in inner Clinton Harbor. Future SAV monitoring can be conducted and subsequently compared to the results of this survey in order to determine changes in the distribution patterns of the seagrass beds.

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